

# OPERATING INSTRUCTIONS FOR

# *PRECISION*

**MODEL**



**E-310**

## SINE and SQUARE WAVE GENERATOR

(Range 5 cps to 600 kc)



## PRECISION APPARATUS COMPANY, INC.

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## INTRODUCTION

The Model E-310 is a wide range Audio-Video Generator, providing both Sine and Square Wave Output over the frequency range of 5 cycles to 600 kilocycles.

Its dual-function features have been designed to provide the most efficient, all-inclusive generator facilities for the Laboratory and for the Audio-Video Service Engineer.

A portion of this manual has been prepared for those who may require re-familiarization with Sine and Square Wave fundamentals and testing techniques. Once a good foundation in audio-video test methods is established, the use of Model E-310 will afford considerable streamlining of Amplifier test procedures with resultant savings in time and effort . . . . and with more uniformly high standards of amplifier performance.

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## GENERAL SPECIFICATIONS

### Frequency Range

(both Sine and Square Wave Output)

5 cycles to 600 kilocycles in five bands

(fx1). . . . . 5 to 60 cycles

(fx10). . . . 50 to 600 cycles

(fx100). . . 500 cycles to 6 kilocycles

(fx1K). . . . 5 kilocycles to 60 kilocycles

(fx10K). . . 50 kilocycles to 600 kilocycles

### Output Characteristics

Minimum recommended load:- 600 ohms

0-10 volts RMS at 600 ohms load flat within 1 Db

Within 1 Db band to band

Max. power output into 600 ohms, approx. 160 MW

Max. Distortion:- Less than 1%

Max. Hum and Noise:- Less than .1%

Square Wave Rise Time:- .15 microsecond

Square Wave overshoot:- negligible

### Calibration Accuracy

1 cycle or 2% - 5 cps to 60 cps

2% 60 cps - 600 Kc

This accuracy specification includes component and tube aging, and dial calibration factor.

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## TUBE COMPLEMENT AND FUNCTIONS

- 1 - 6CB6 Variable Frequency Oscillator
- 1 - 6CL6 Cathode Follower-Buffer for the 6CB6 VFO
- 1 - 6BQ7A Square Wave Clipper
- 1 - 6BL7 Series-connected Push-Pull Output
- 1 - 6X4 Rectifier

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### DESCRIPTION AND FUNCTIONS OF PANEL CONTROLS AND SWITCHES

All panel controls and components are used in identical fashion for either Sine or Square Wave Output. Conversion from Sine Output to Square Wave Output and vice versa is simply accomplished by use of the "Waveform" Switch at the lower left corner of the instrument panel:-

1. "Range" Switch - 5 frequency ranges for both Sine and Square Wave Output are selected through use of this switch.
2. "Output Level" Control & "Output" Controls:- Sine or Square Wave Output from the final amplifier of the E-310 is fed to the "Output Level" potentiometer. The signal from the arm of this potentiometer is then fed to a decade attenuator, controlled by the "Output" knob. Maximum output is therefore obtained with the "Output Level" Control turned clockwise to 100 and with the "Output" Switch set to "x1".

NOTE: To preserve the optimum characteristics of Square Wave Output, the "Output" knob on the decade attenuator should be kept in the "x1" position. The Square Wave Output is then controlled by use of the "Output Level" Control. This note becomes more important at the upper frequency limit of Square Wave Output. At low frequencies, the "Output" decade attenuator has relatively little effect upon the Rise Time and general characteristics of the Square Wave Output.

3. "Waveform" Switch - This switch converts the Output of the E-310 from Sine to Square Wave or vice versa.
4. "Output" Posts - These posts provide Output termination for Model E-310.
5. "Meter" Panel Jacks - These jacks permit access to the arm of the "Output Level" Control. A low range, wide band AC Voltmeter connected to these jacks will provide monitoring facilities to the input of the decade attenuator. All voltage readings at these jacks should be multiplied by the "x.001", "x.01", "x.1", "x1" factor of "Output" Switch to determine the voltage appearing at the "Output" posts.
6. "Vernier" Knob - This vernier knob provides 12 to 1 reduction ratio in the drive for the main tuning gang assembly.
7. Main Tuning Dial - The frequency of all Sine-Square Wave is indicated directly on this main tuning dial; all readings on this dial must be multiplied by "fx1", "fx10", "fx100", "fx1K", and "fx10K", multiplying factors on the "Range" Switch.

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### MISCELLANEOUS FEATURES

Etched-Anodized Tuning Dial and Panel both of heavy gauge aluminum, resistant to moisture and abrasion. NO-glare, engine-turned dial finish and satin aluminum panel field, afford utmost visibility and ease of reading.

Fully licensed under patents of RCA, Western Electric and AT & T.

Full One Year Warranty:- Series E-310, as do all PRECISION products, carries a factory warranty against any defective parts or workmanship for a period of one year from date of purchase. See warranty certificate for complete statement of terms and conditions.

PRECISION Performance, Stability and Accuracy:-

Carefully engineered circuitry, plus preselected-pretested components, plus controlled production-engineering - - - - assures the highest performance standards to be expected from an instrument such as the Series E-310.

\* www.everything4lessstore.com \*

### SET-UP AND TYPICAL APPLICATION

1. Insert the Line Plug into a source of 110/120 volts 50/60 cps power.

**CAUTION:**

Do not connect this instrument to a power source other than that described above **UNLESS** your particular instrument has been otherwise designed and is so identified.

2. Snap the LINE Toggle Switch ON.
3. Allow a warm-up period (for maximum stability) of about 15 minutes.

We will assume for the purpose of describing a typical application that a simple frequency response test is to be performed on an Audio Amplifier.

4. Set the Controls and Switches of the E-310 as follows:-

"Waveform" Switch to "SINE"

"Range" Switch to "50-600"

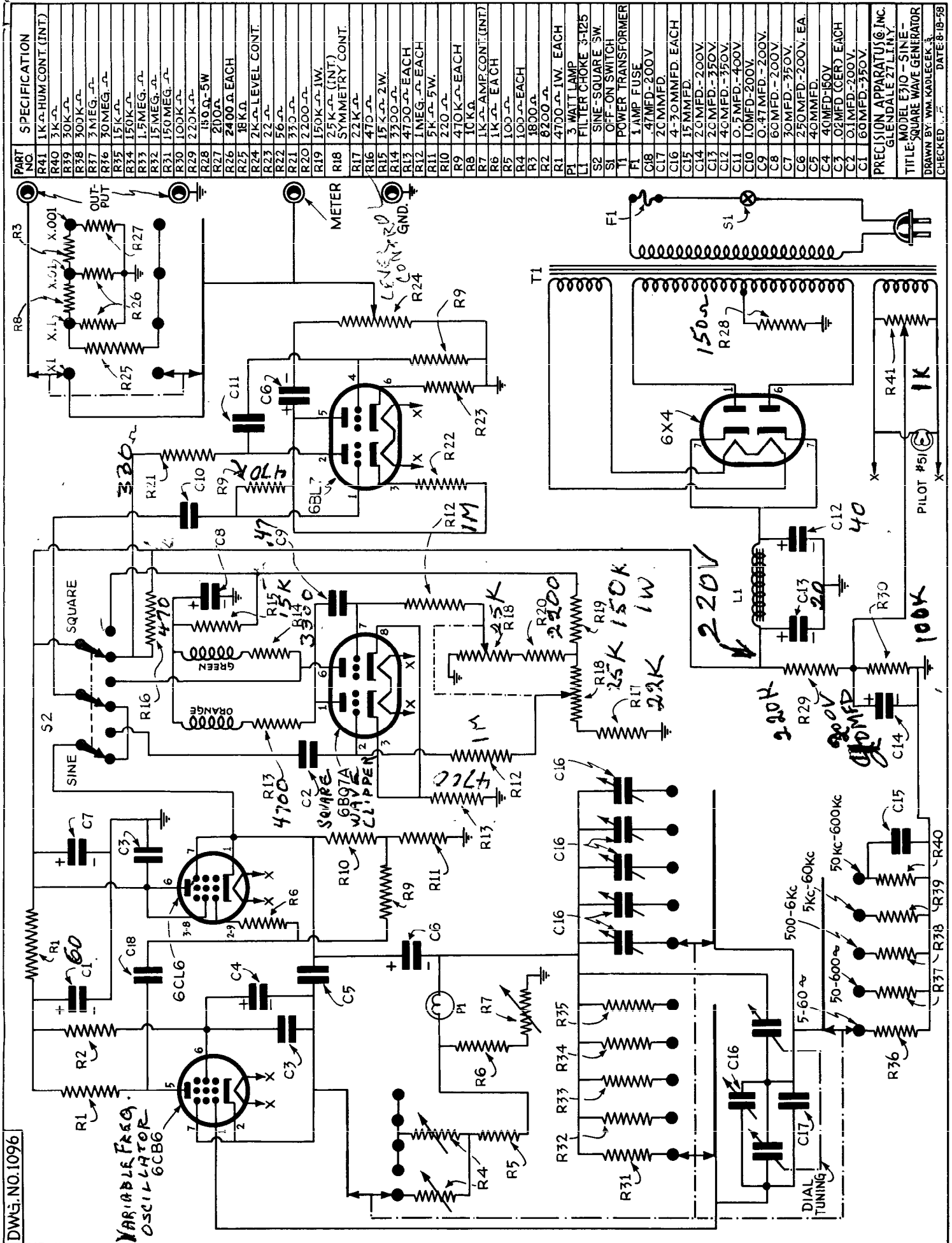
"Output Level" Control to approximately 50

"Output" to "x1"

5. Connect the "G" (Ground) Binding Post of the E-310 to ground of the amplifier; connect the other output post of the E-310 to the input of the amplifier.
6. As an indicator of output from the amplifier, any high impedance AC measuring instrument with flat response over the anticipated frequency range may be used. A VTVM equipped with AC measuring facilities, such as PRECISION Model 68 or 88 may be used; however, the OSCILLOSCOPE is one of the most useful High Impedance Vacuum-Tube-Voltmeters available to the technician-engineer. We will therefore assume that an Oscilloscope such as PRECISION Model ES-550 equipped with a Low Capacity Probe (SP-5A) is connected directly across the output (the speaker voice coil or to the plate of the last amplifier).
7. Set the E-310 Tuning Dial to 60 cps for example and adjust the gain of the 'Scope and the output of the E-310 to obtain a good sized sine pattern on the 'Scope screen, always keeping in mind the caution that the output of the E-310 be kept at a minimum, consistent with operating conditions, in order to minimize the possibility of overloading the amplifier and introducing false indications of distortion.  
  
Use the "Output Level" Control to set the maximum Output desired from the E-310 and then use the "Output" Switch to reduce the Output from the E-310 by factors of 10.
8. Note the total height of the sine pattern on the 'Scope screen by counting the number of vertical squares it occupies on the 'Scope's calibrated cross-hatch mask. (Peak-to-peak measurement).
9. Now, without touching any other controls or switches, merely rotate the tuning dial of the E-310 to 200 and note the difference, if any, in the height of the sine pattern on the 'Scope.
10. Repeat the procedure for as many frequency points as required to display the curvature of the amplifier response, using the peak-to-peak sine wave amplitude readings as read on the 'Scope's cross-hatch mask.

**NOTE:** The flat output of the E-310 permits the use of the generator as noted above without repeated VTVM measurements of direct generator output at the various frequencies.

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*It is not 'PRECISION' Test Equipment unless it is manufactured by  
Precision Apparatus Company, Inc., of Glendale, L. I., N. Y.*